

Developments for New Xray Telescope (NeXT) mission

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ISAS

Supermirror telescopes

Hybrid imager

TES calorimeter

Hard X-Gamma ray detectors

Scientific Objectives and Mission Concept I

Hard X-ray Imaging of Cluster of Galaxies
Acceleration of charged particles
--> Supermirror hard X-ray telescopes
Hard X-ray Imaging detector
1000cm² @30 keV
--> 5×10^{-13} erg/s/cm²(20-40keV) 100ksec
non thermal components

Scientific Objectives and Mission Concept II

High resolution spectroscopy

Conversion of kinetic energy of bulk motion
to thermal/non thermal components

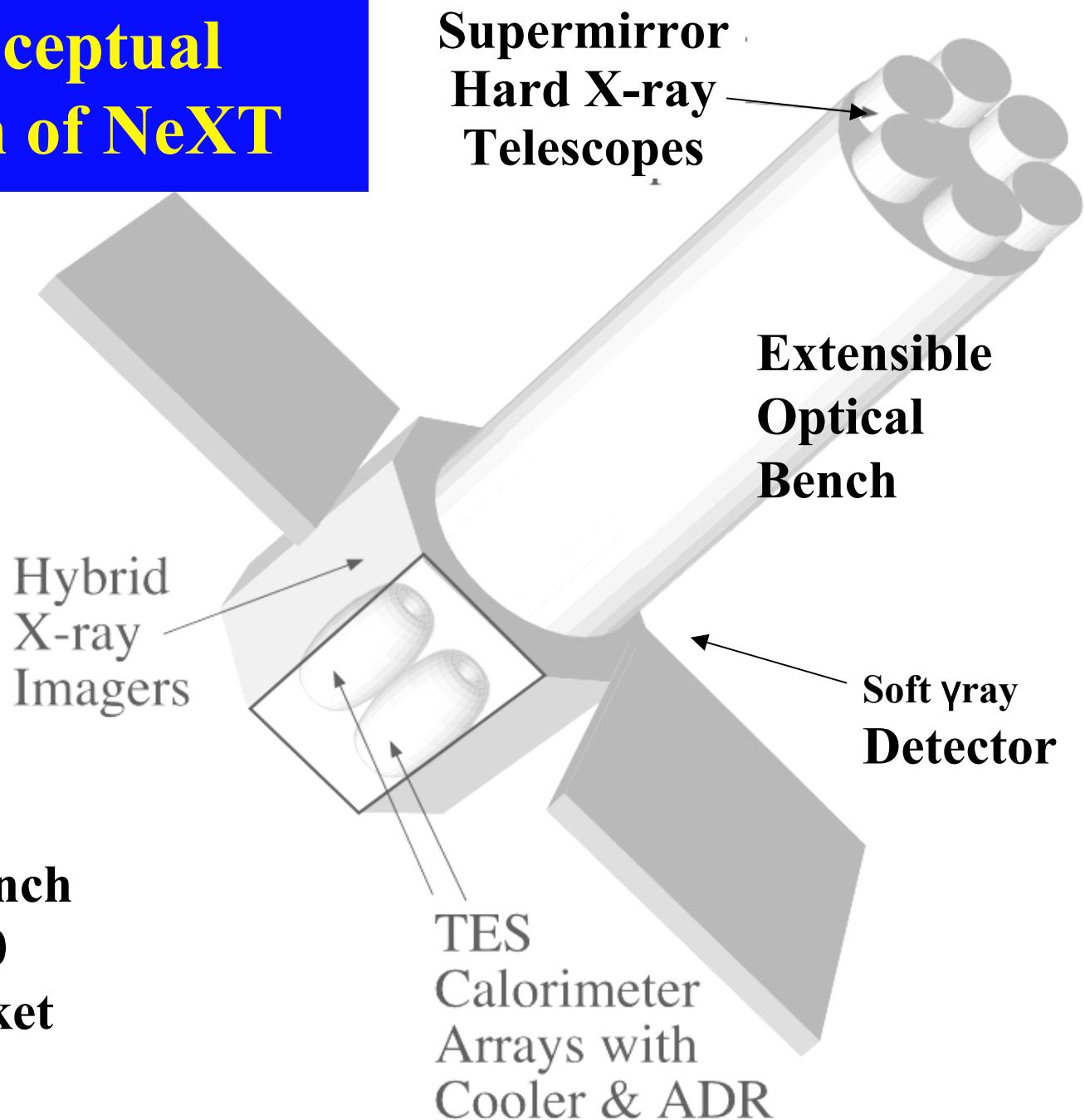
--> TES calorimeter array

Hard X & γ -ray spectra

High energy particles

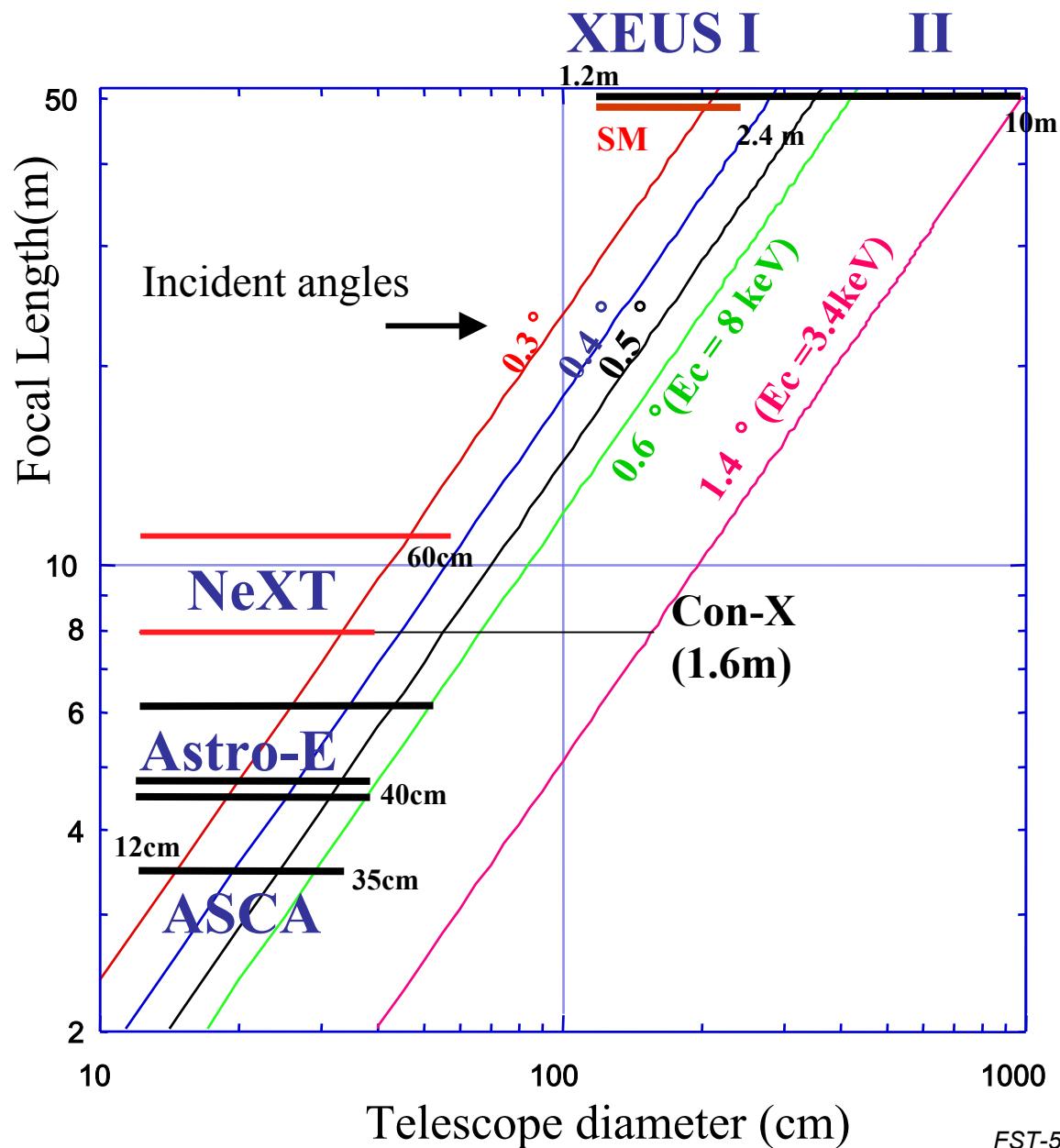
--> Low background/noise detectors

Conceptual design of NeXT



High throughput X-ray telescopes

ASCA-Astro-E type
Diameter : 60 cm
6 m Focal length
 $\theta \leq 0.6$ degree
Pt mono layer
 < 10 keV



Multilayer Design

Design concept

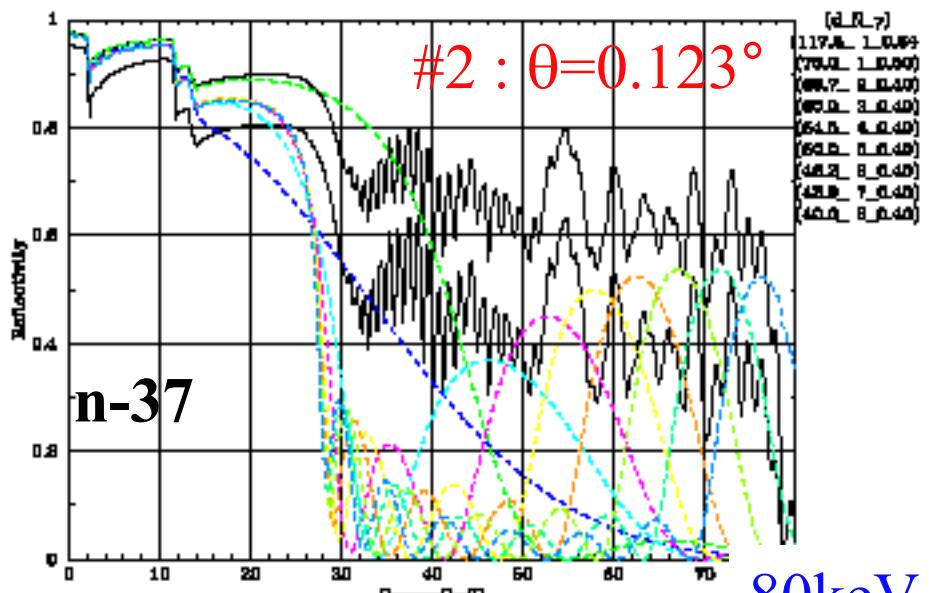
1. Maximize integrated reflectivity in **20-78 keV** band
2. Flat top response
3. Minimum number of layer pairs
4. Pt/C supermirror with gamma = 0.4
5. Block method
6. Incident angle from **0.11** to **0.35** degrees
7. d-spacing of **2.4-7.5 nm**
8. Maximum layer pairs is < 138

$\sigma = 0 \text{ nm}$

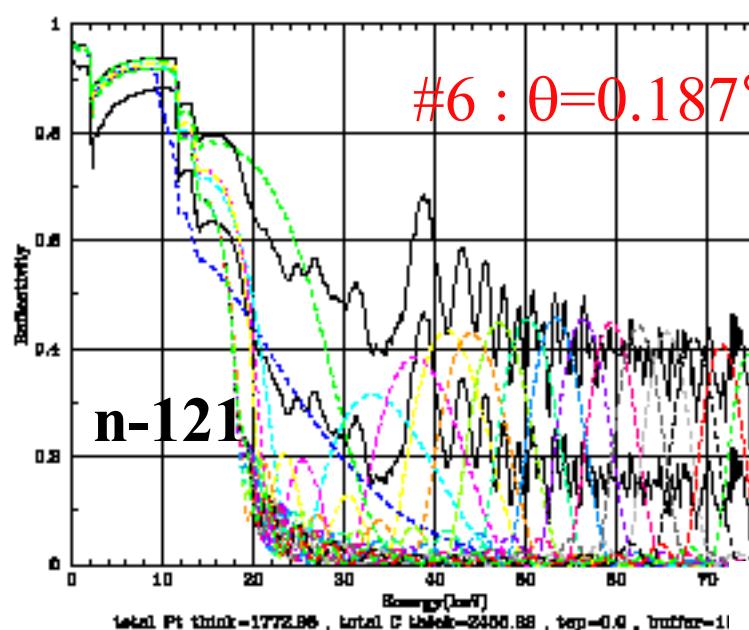
Reflectivity of supermirros

Tamura et al.

Incident Angle=0.183[deg.] , roughness=0.0 , total N=37 , block=8



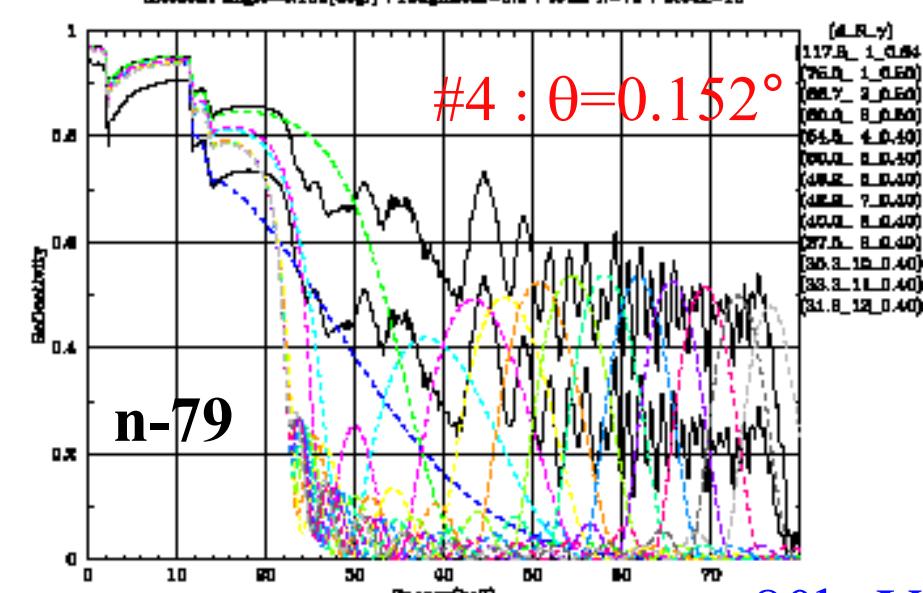
Total Pt thick=784.01 , total C thick=1087.74 , top=0.0 , buffer=10
Incident Angle=0.183[deg.] , roughness=0.0 , total N=181 , block=18



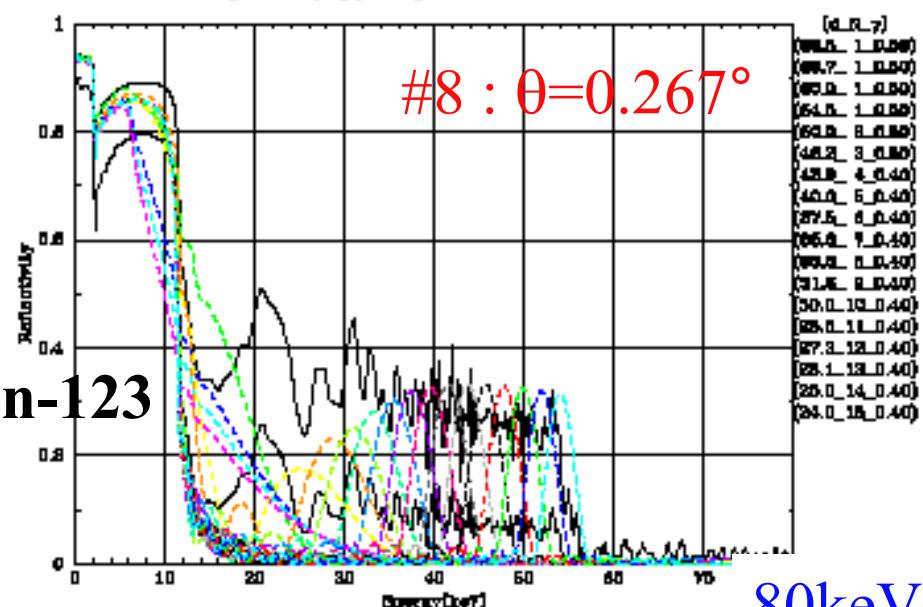
Total Pt thick=1772.86 , total C thick=2450.88 , top=0.0 , buffer=10

Se

Incident Angle=0.183[deg.] , roughness=0.0 , total N=79 , block=13



Total Pt thick=1889.70 , total C thick=1915.00 , top=0.0 , buffer=10
Incident Angle=0.280[deg.] , roughness=0.0 , total N=123 , block=18



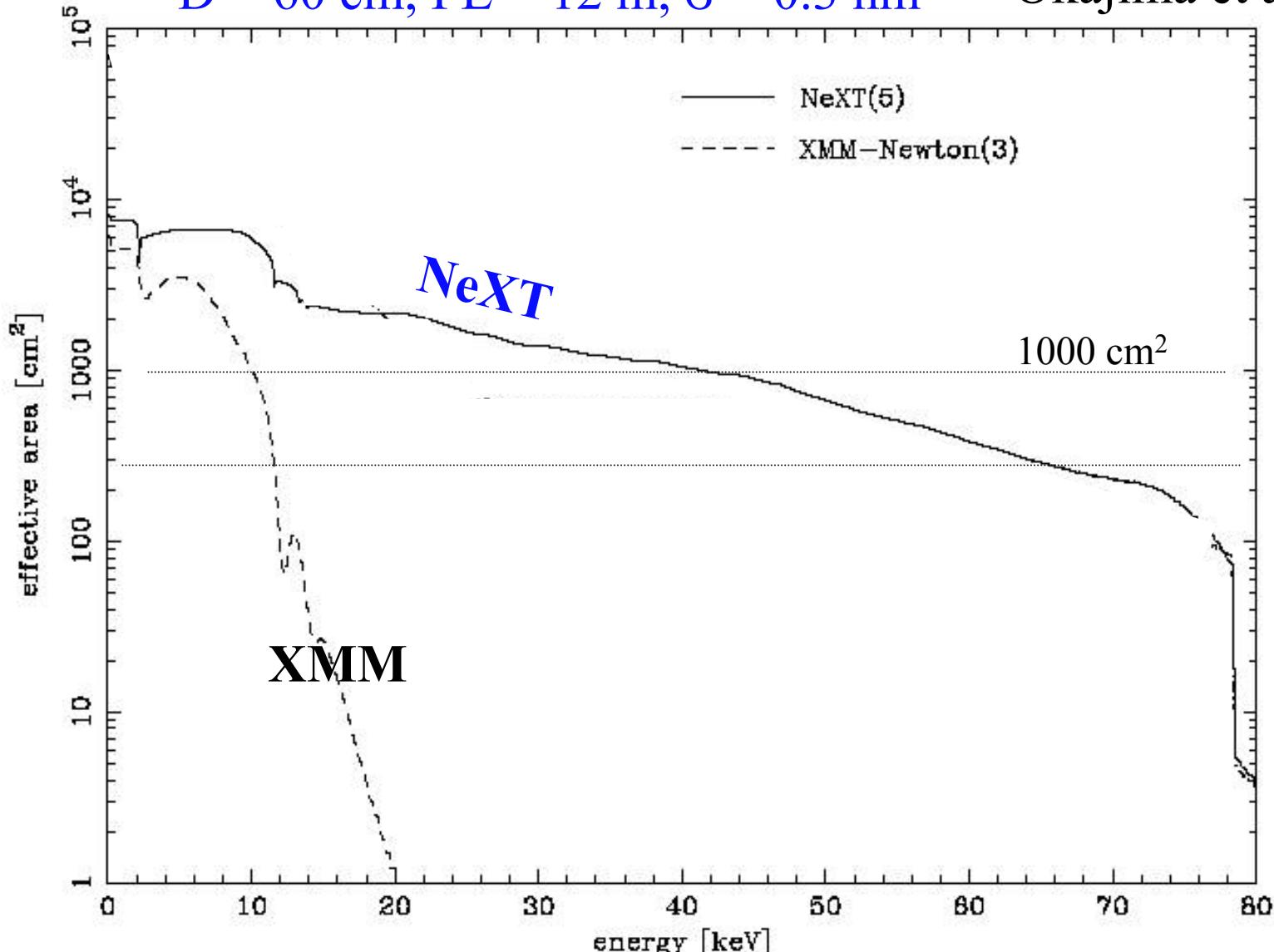
Total Pt thick=1818.83 , total C thick=2278.87 , top=0.0 , buffer=10

80keV

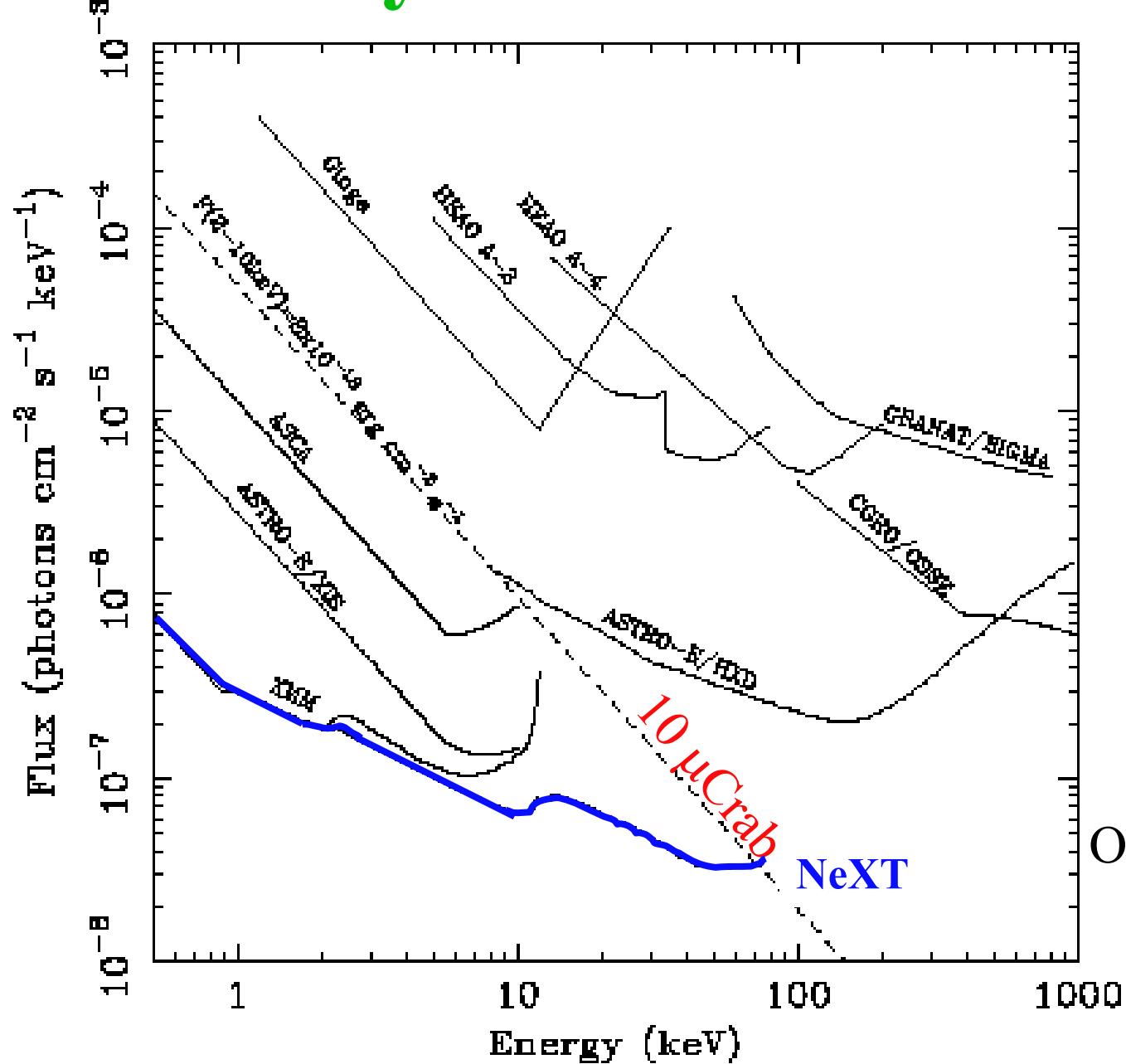
Effective Area of 5 telescope

D = 60 cm, FL = 12 m, σ = 0.3 nm

Okajima et al.



Sensitivity of various missions



Okajima et al.

Production of ML replica foils

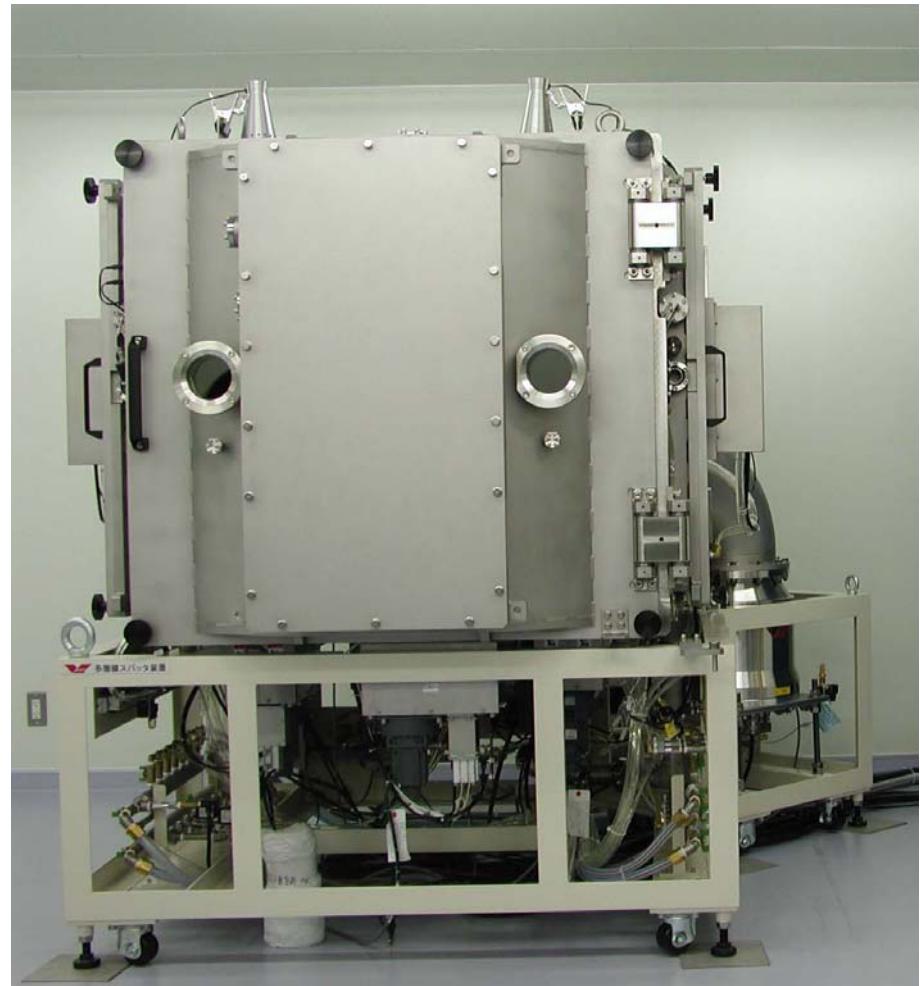
Nagoya University

Multilayering on Pt replica mirrors ---> InFOCuS

Multilayer replication --> InFOCuS-2

Mass production

ISAS Test facility
Multilayering
Replica system
(being prepared)



InFOCuS Balloon Project

International Focusing Optics Collaboration for vCrab Sensitivity
(NASA/GSFC, Nagoya Univ., ISAS)

Supermirror Hard X-ray Telescope

(NASA/GSFC+Nagoya Univ.+ISAS)

CdZnTe 12x12 pixel detector

(NASA/GSFC)

8 m focal length

Launched on July 5, 2001

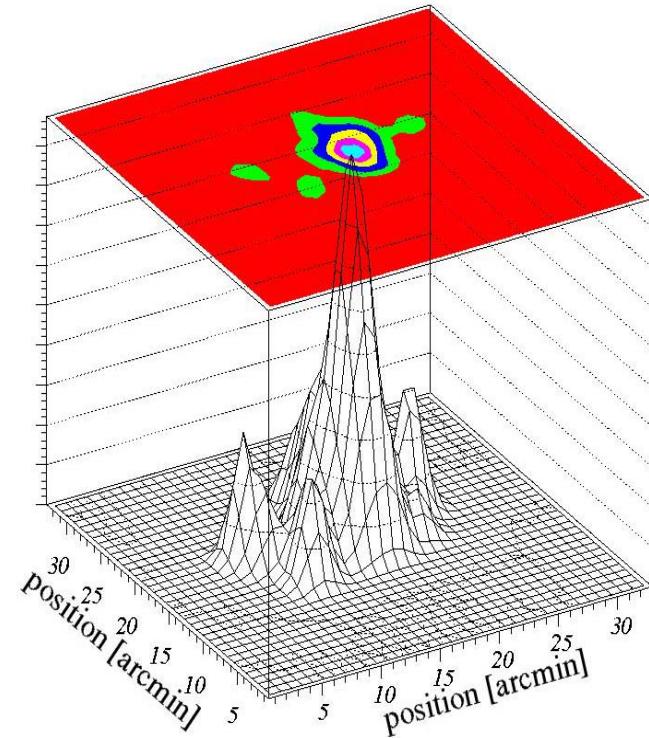
Palestine, Texas



InFOC μ S Balloon Experiment



Preliminary hard X-ray
(20-40 keV) Image
of Cyg X-1



NASA/NSBF Palestine, TX

Hybrid X-ray Imaging Detector

BI CCD Camera
→ Soft X-ray Imaging
 $E < 10 \text{ keV}$

ISAS/Osaka/Kyoto Univ.

Hard X-ray Imager

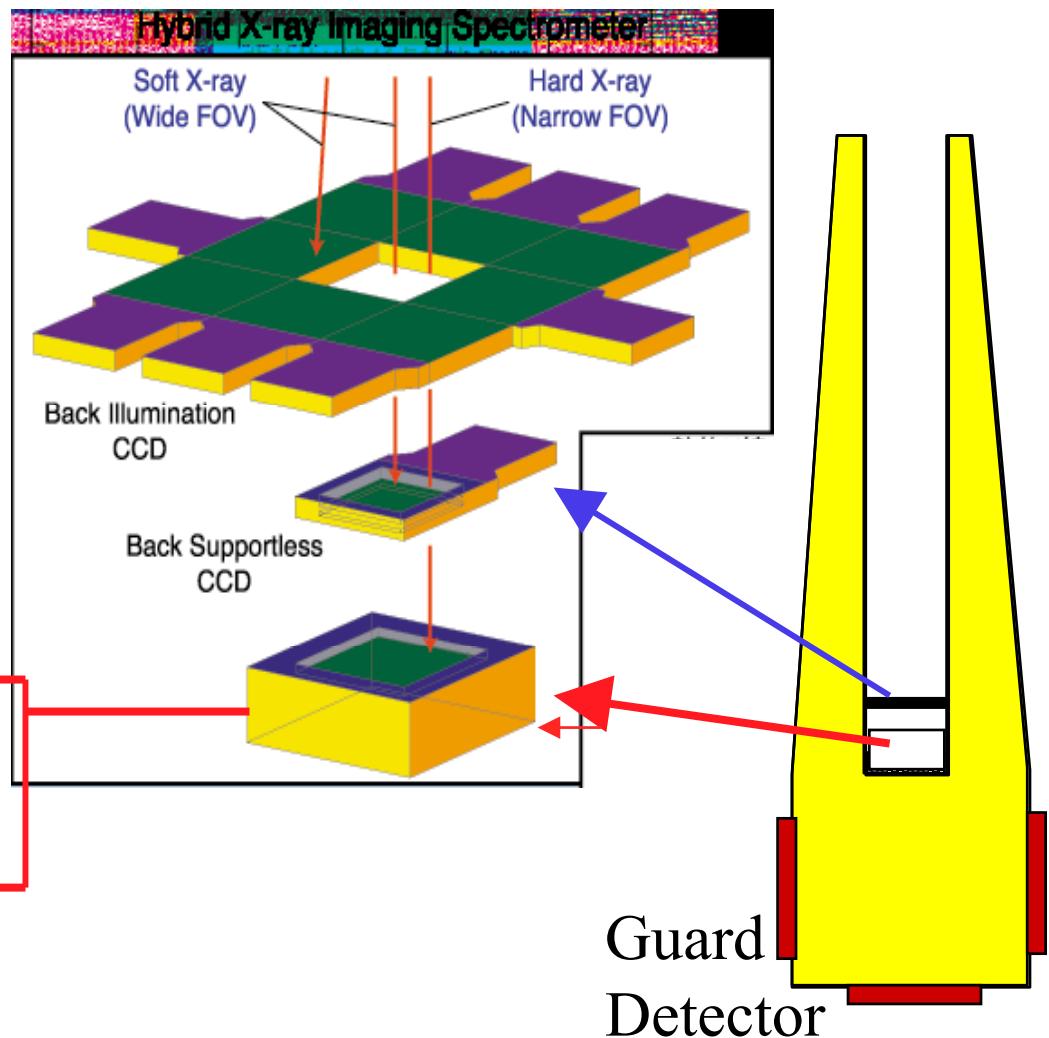
CdTe Pixel detector

ISAS

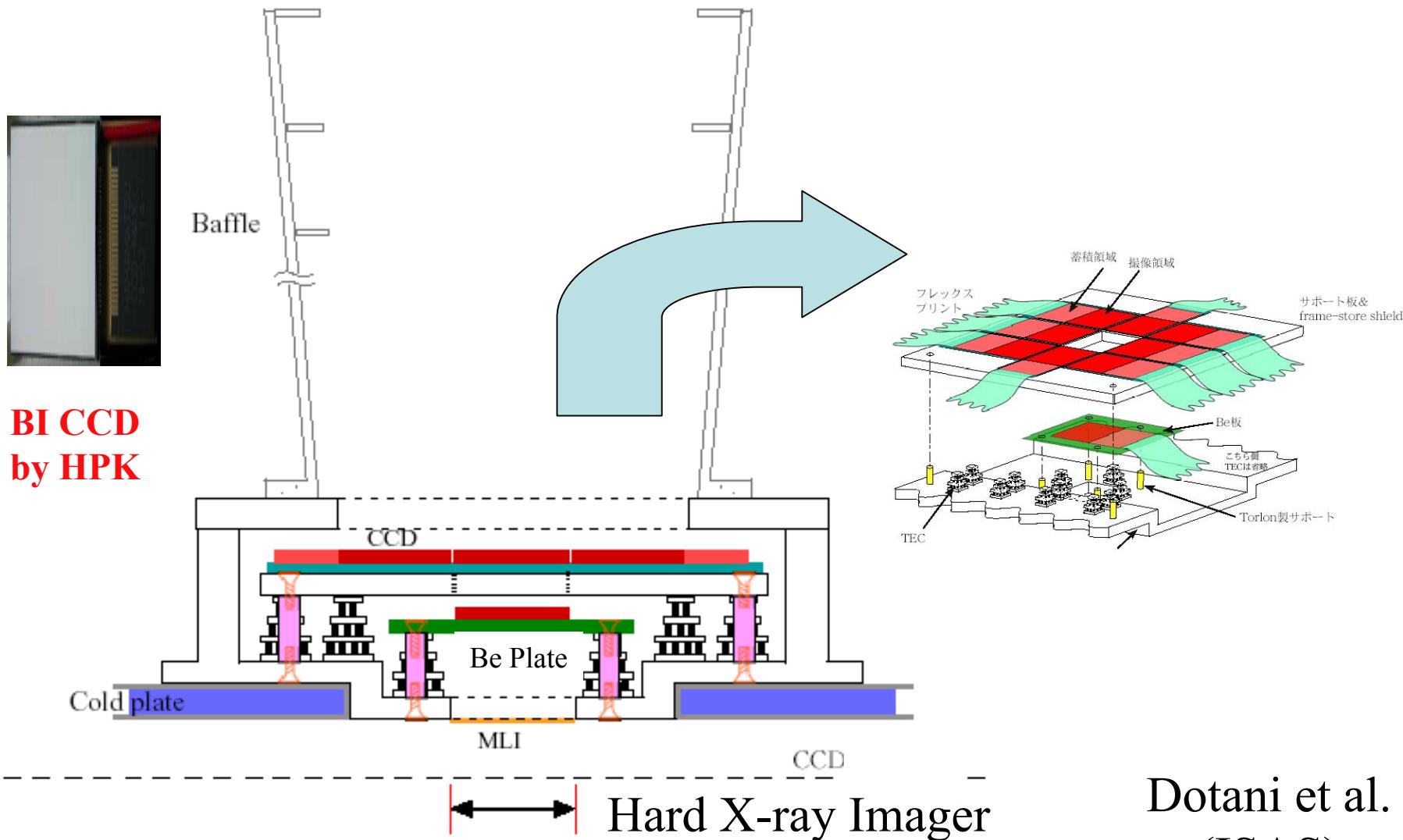
or

Gas Imaging Detector

Kyoto Univ.

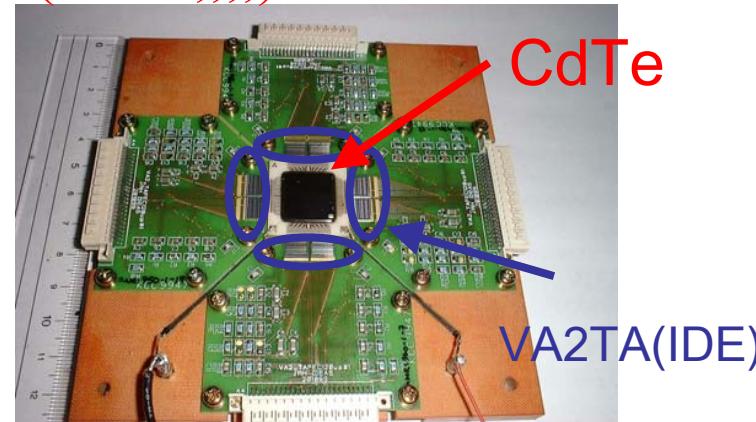
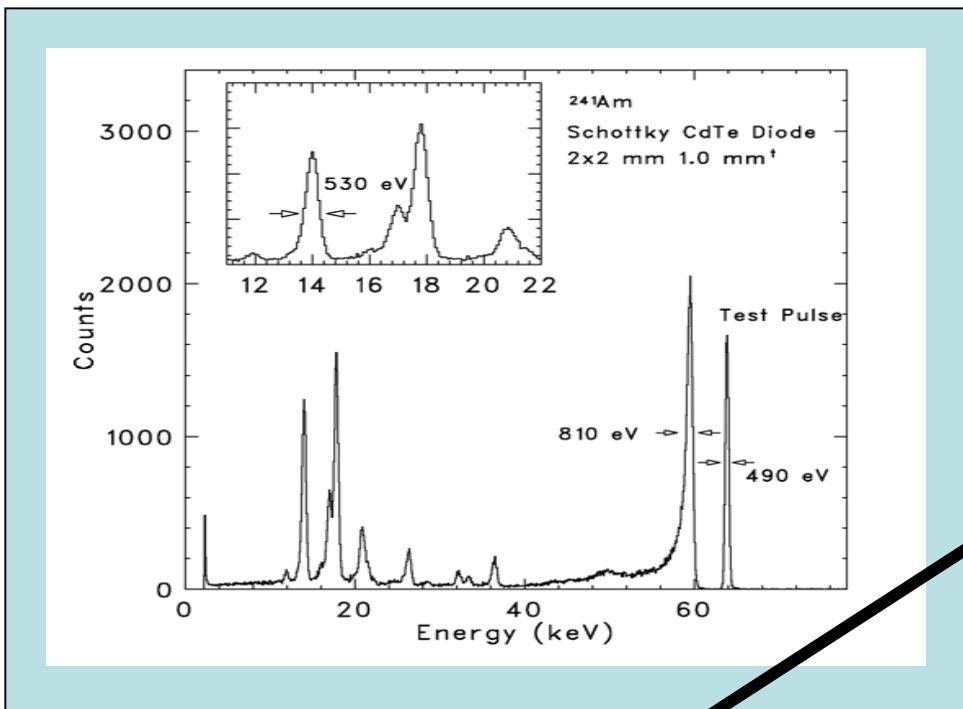


Thin CCD Soft X-ray Imager

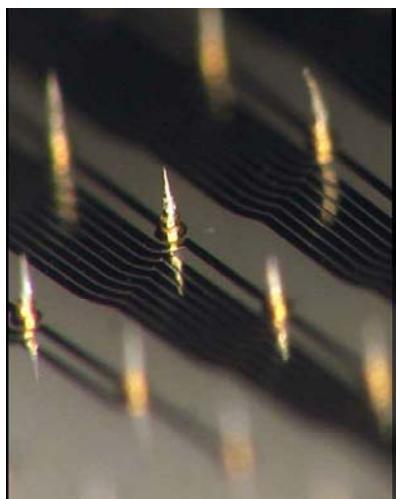


CdTe Pixel Detector

(ISAS,,,)

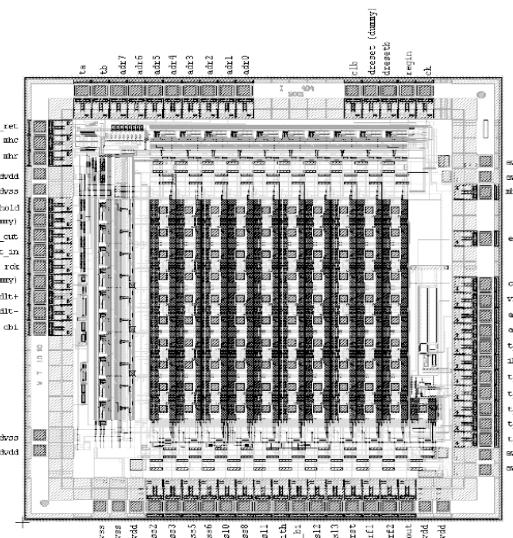


0.6mm[□] 20x20



2-D array

Au stud bump
read out to
ASICs



0.2mm[□] 32 x32

Takahashi et al. (ISAS)

Micro Pixel Gas Detector

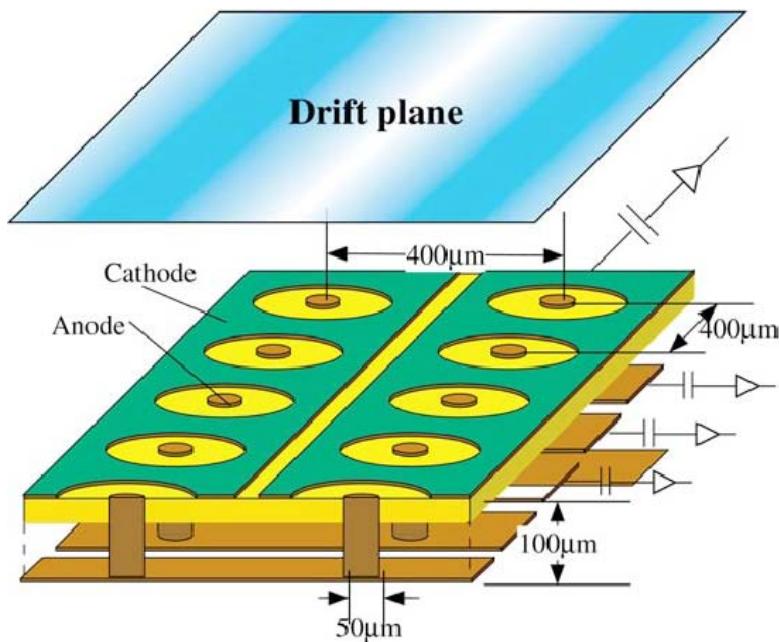
(Kyoto University)

Spatial Resolution of 0.2 mm

Energy resolution of ~1keV @ 6 keV

$E \leq 40$ keV(depending on the drift region)

Capability of Polarimetry Modulation factor =15% @10keV

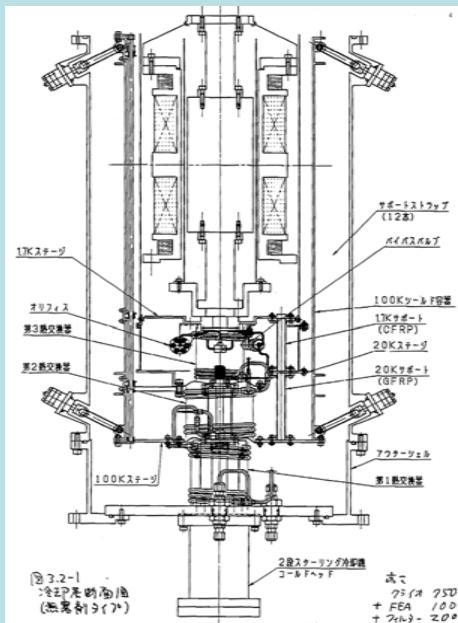


0.4mm pitch, 0.05mm dia. electrodes

High resolution spectrometer array

(ISAS, Waseda and Tokyo Met. Univ.)

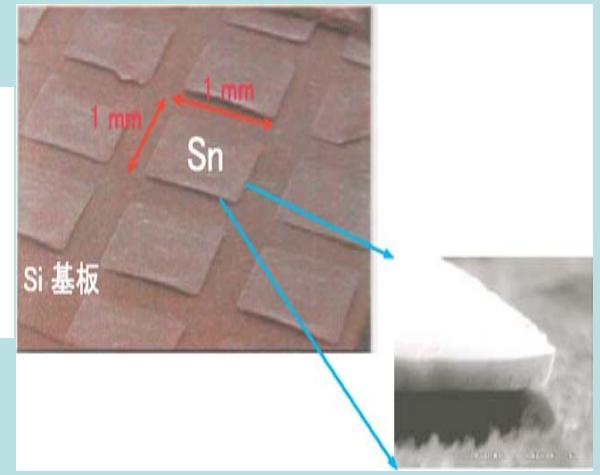
Mechanical cooler + ADR (Cryogen-less)



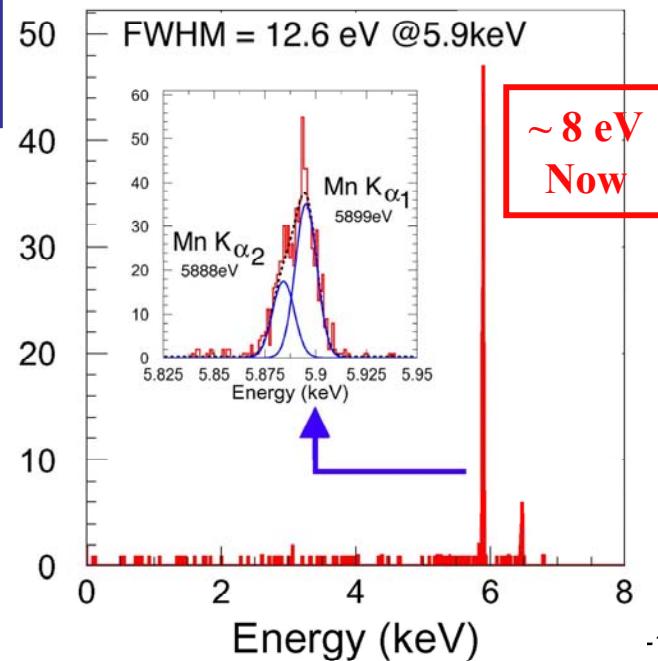
ADR
parts



Sn absorber
array wth
electrodeposition
process

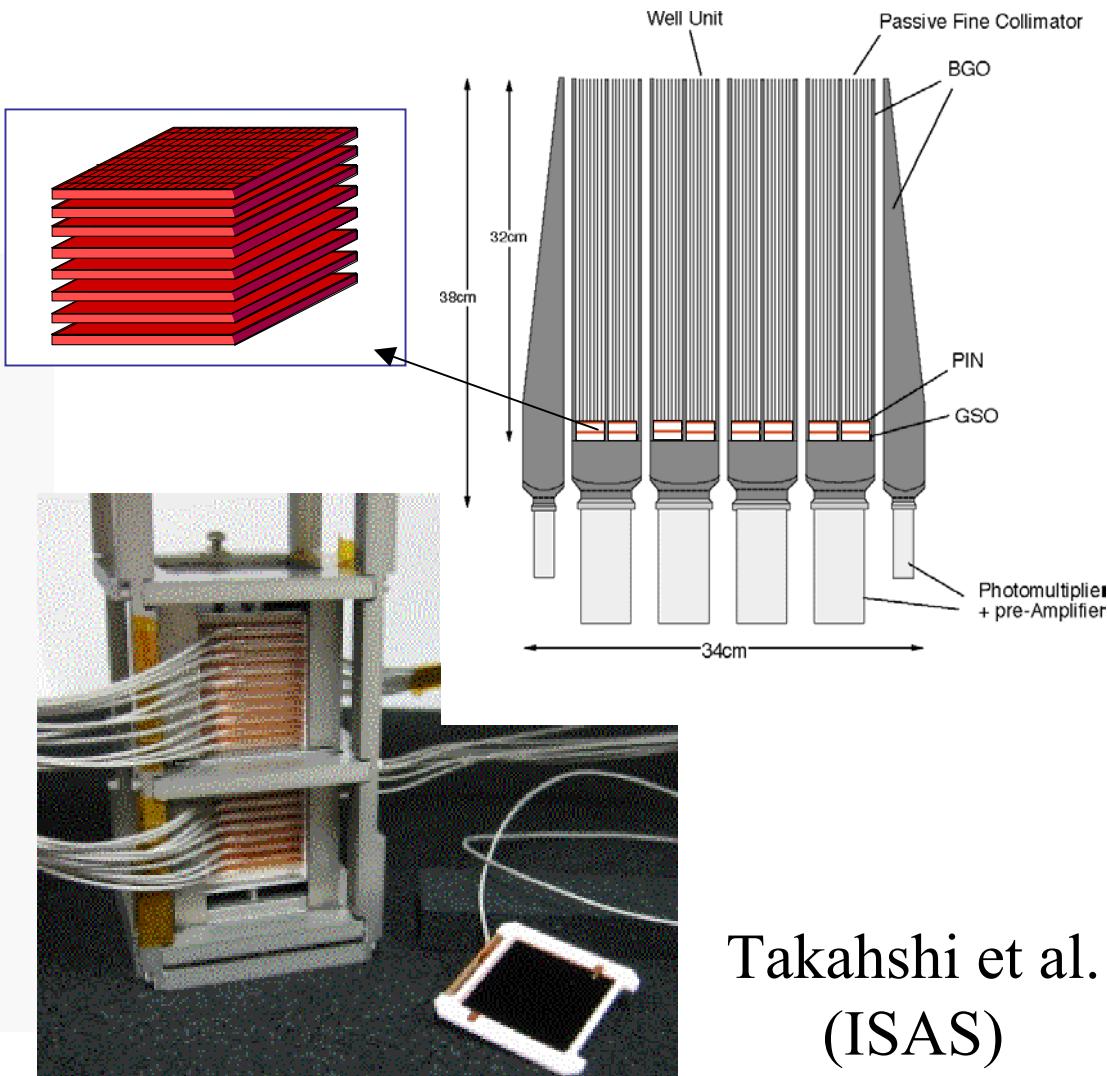
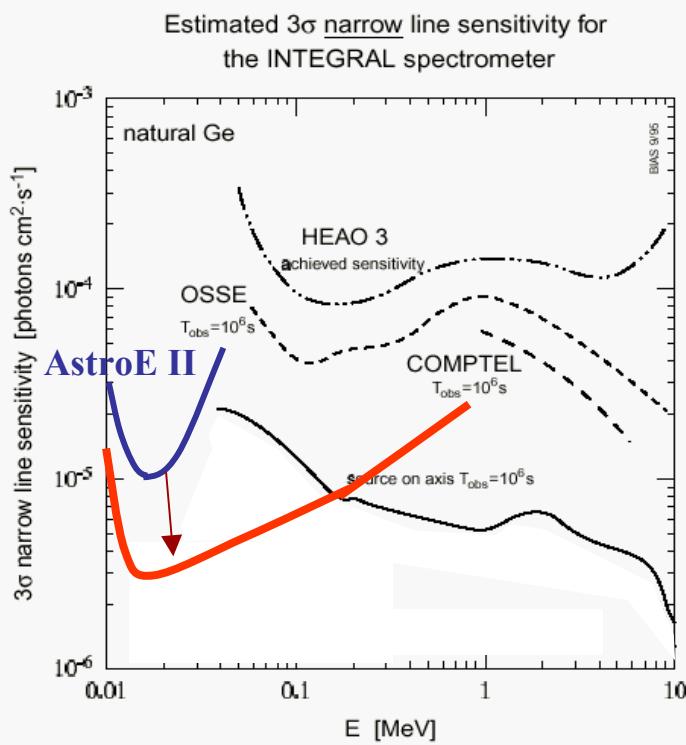


TES
calorimeter



Hard X-ray/Soft Gamma ray Detector

Ultra-low Background
 Pixel type CdTe detector stack
 with Well type BGO Collimator



Takahshi et al.
 (ISAS)

Current plan

Astro-E2

